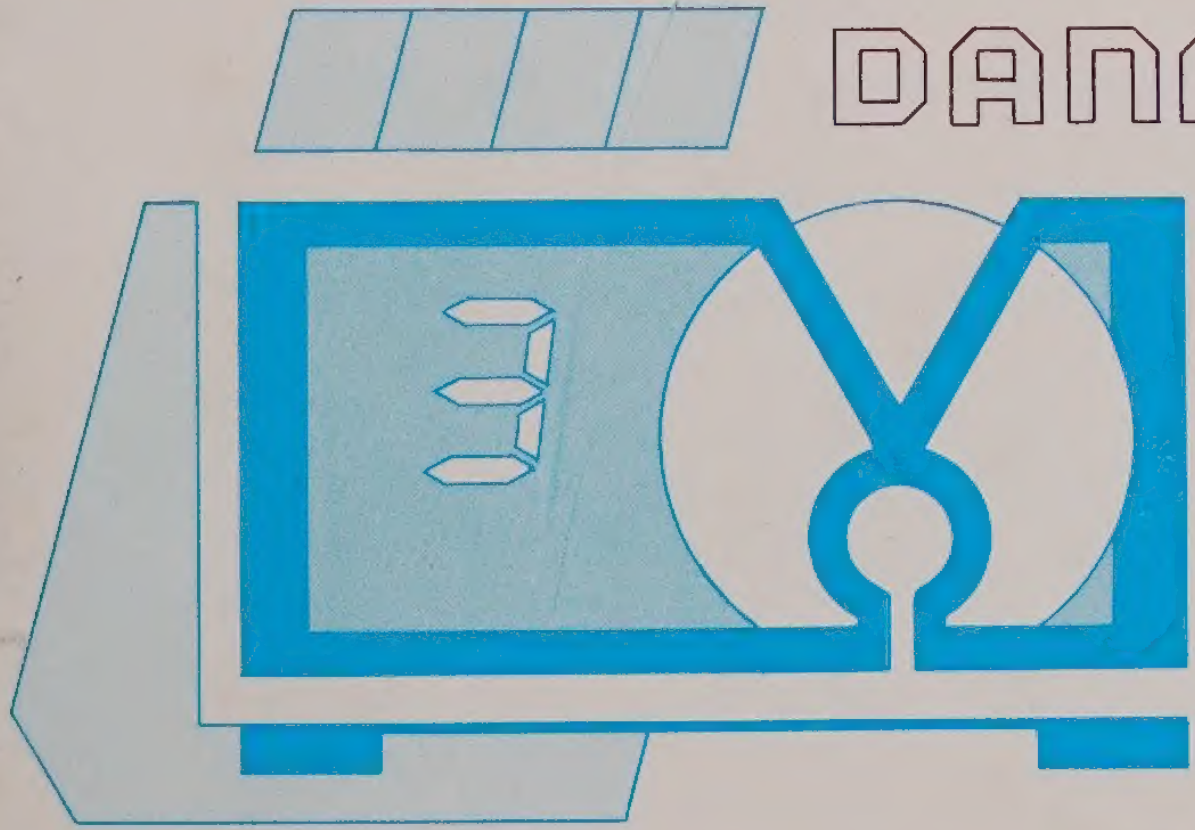
INSTRUCTION MANUAL

DANAMETER



DANA®

WARRANTY

Within one year of purchase, Dana Laboratories will repair or replace your instrument, at our option, if in any way it is defective in material or workmanship (battery excluded). All parts and labor charges will be paid by Dana Laboratories. Contact your local Dealer in the event service is required.

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SECTION 1 GENERAL DESCRIPTION

1.1 GENERAL.

1.2 Your Danameter solid state volt-ohm-microamp meter is designed for the engineer, technician, and hobbyist who requires a rugged, portable, accurate, and reliable measurement tool. The Danameter is capable of performing a wide assortment of measurement functions and is equally useful on the bench or in the field. Measurement capabilities include d.c. volts from 1 millivolt to 1000 volts, a.c. volts from 1 millivolt to 700 volts RMS, resistance from 100 milliohms to 199.9 megohms and d.c. current from 10 nanoamps to 2 amps. With accessories the capacity of the instrument is expanded to include RF voltage with frequency measurements to 200 MHz and high voltage on d.c. with measurements to 30,000 volts. Built with state-of-the-art LSI circuitry and housed in a virtually unbreakable Cycolac T case, your Danameter will provide you with years of reliable service.

1.3 FEATURES.

1.4 Fully Portable. Operates up to one full year on a single 9-volt (transistor radio type) dry battery. A switch position

is provided to measure the battery voltage. The instrument is extremely light, weighing only 1 pound and operates at full accuracy at any angle. A handy carrying case is available.

1.5 Easy to Operate. One switch selects off/on, battery test, and all functions and ranges. Input leads are never required to be moved for a special range, function, or polarity.

1.6 Digital Display. Liquid crystal readout provides large easy to read numbers and decimal placement as well as automatic polarity indication on DC volts and current measurements.

1.7 High Input Resistance. Ten megohms on all d.c.v. ranges and two megohms on all a.c.v. ranges insures higher measurement accuracy in high impedance circuits and minimizes affecting circuit operation when measurements are being taken.

1.8 Overload Protection. Instrument accepts overload voltages of 250V d.c. or RMS a.c. on all ohms and d.c. current ranges, 250V d.c. or 1000V peak a.c. on all a.c. volt ranges, and 1000V d.c. or peak a.c. on all d.c. volt ranges. Positive overload indication is provided on the display.

1.9 SPECIFICATIONS.

1.10 Specifications are given in table 1.1.

Table 1.1 - Danameter Specifications

DC	
Ranges:	2, 20, 200V, 1 KV
Overload Protection:	Any Range 1000V DC or peak AC
Accuracy:	2V 90 days, ±10°C ±(.5% of reading +.05% of range) 1 year (typically), ±10°C ±(.7% of reading +.1% of range) 20, 200V, 1 KV 90 days, ±10°C ±(.75% of reading +.05% of range) 1 year (typically), ±10°C ±(.95% of reading +.1% of range)

DC (continued)	
Polarity:	Automatic
Temperature Coefficient:	5°C to 15°C, 35°C to 50°C ±(.02% of reading +.005% of range)/°C
Input Resistance:	All Ranges 10 Megohms
NMR:	at or near 60 Hz 50 dB Min.
Settling Time:	Typically, ≤1 sec.

Table 1.1 - Danameter Specifications (continued)

AC	
Ranges:	2, 20, 200V, 1 KV
Overload Protection:	Any Range (250V DC Max) 1000V peak Max.
Accuracy: **(From 45 Hz)**	2V 90 days, ±10°C to 2 kHz ±(2.5% of reading +.15% of range) 1 year (typically), ±10°C ±(3% of reading +.2% of range) 20, 200V, 1 KV 90 days, ±10°C to 5 kHz ±(2.5% of reading +.15% of range) 1 year (typically), ±10°C ±(3% of reading +.2% of range)
Input Resistance:	2 Megohms
Input Capacitance:	40 pF
Settling Time:	Typically less than 2 seconds

CURRENT (DC)	
Ranges:	20 μA, 2 mA, 200 mA, and 2A
Accuracy:	20 μA, 2 mA, 200 mA, 2A 90 days, ±10°C ±(2% of reading +.1% of range) 1 year (typically), ±10°C ±(3% of reading +.15% of range)
Settling Time:	Typically ≤1 second
Voltage Burden:	.25V maximum up to 1/2 amps
Overload Protection:	Any Range (5 sec. max. 20 μA range) 250V DC or VRMS

Table 1.1 - Danameter Specifications (continued)

OHMS	
Ranges:	200Ω, 20 KΩ, 2 MΩ, and 200 MΩ
Overload Protection:	Any Range 250V DC or VRMS AC
Accuracy:	200Ω 90 days, ±10°C ±(3.5% of reading +.15% of range) 1 year (typically), ±10°C ±(4% of reading +.2% of range) 20 KΩ 90 days, ±10°C ±(1.5% of reading +.1% of range) 1 year (typically), ±10°C ±(2% of reading +.15% of range)

OHMS (continued)	
	2 MΩ 90 days, ±10°C ±(3.5% of reading +.05% of range) 1 year (typically), ±10°C ±(4% of reading +.1% of range) 200 MΩ 90 days, ±10°C ±(8% of reading +.05% of range) 1 year (typically), ±10°C ±(10% of reading +.1% of range)
Maximum Current Through Unknown:	1 milliampere
Voltage Across Unknown for Full Scale Indication:	200Ω, 20K – 200 mV 2M, 200M – 2V

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2.1 UNPACKING.

2.2 Your Danameter comes complete with Battery and input probes. If either is missing or damaged notify your dealer immediately. Read the General Description to familiarize yourself with the instrument before attempting to install battery.

2.3 GENERAL DESCRIPTION.

2.4 Front Panel. The front panel of the Danameter is shown in figure 2.1. Important features of the front panel are listed in the following paragraphs.

a. Readout. The readout, located at the top left corner of the Danameter, is an easy-to-read, 4-digit, numeric display that also provides decimal, polarity, and overload indication.

b. Range/Function Switch. The range/function switch is a rotary 18-position control, located on the right side of the instrument. This control selects four ranges of DC volts, four ranges of AC volts, four ranges of resistance measurements,

four DC current measurement ranges, a Battery test position, and OFF. The switch may be rotated in either direction.

c. Input Jacks. Only two input jacks are required for all Danameter functions and ranges. These are located at the bottom left corner and marked + and –; the red probe is connected to the + Jack and the black probe is connected to the Jack. For measurements of DC voltage and current, the black probe (– Jack) is considered the reference; the Danameter display indicates + when measuring a signal more positive than the black probe and – when measuring a signal more negative than the black probe.

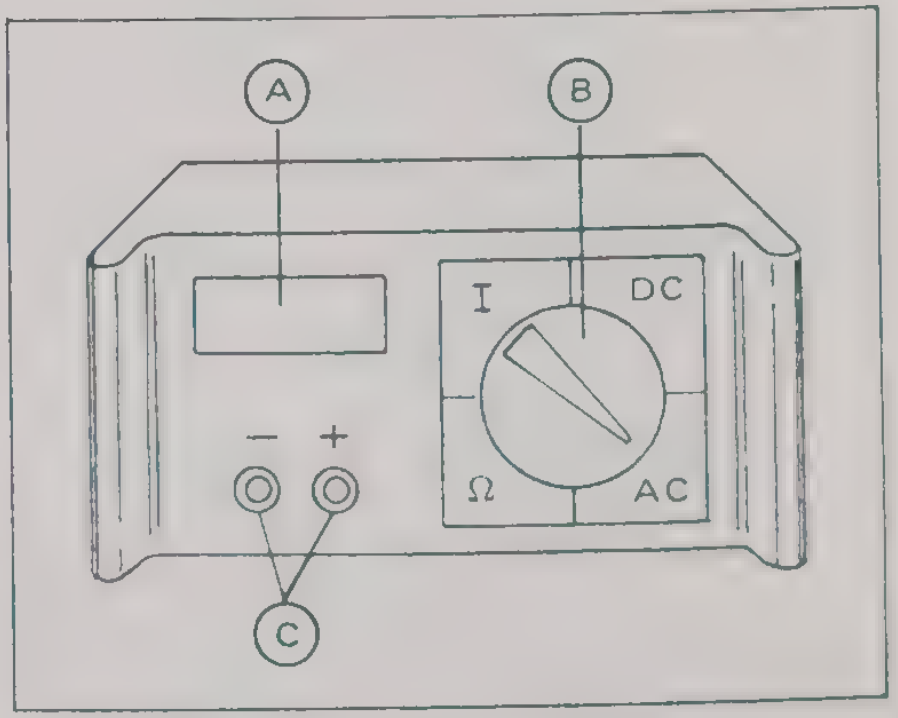


Figure 2.1 - Front Panel

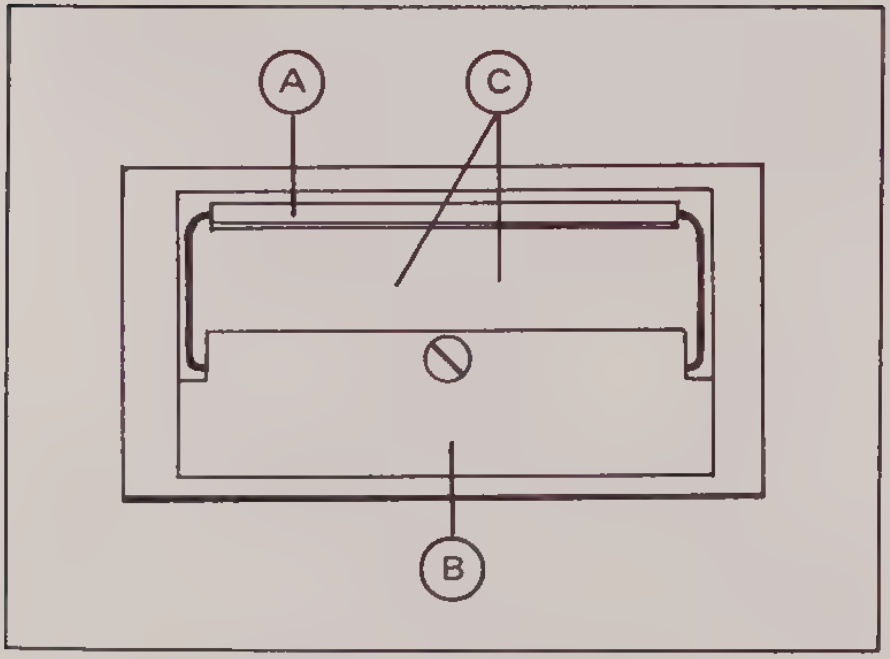


Figure 2.2 - Rear Panel

2.5 Rear Panel. The rear panel of the Danameter is shown in figure 2.2. Important features of the rear panel are listed in the following paragraphs.

a. Bail. The bail is located in the upper portion of the rear panel and allows the instrument to be positioned at 45° and 75° angles from the normal upright position. The bail can also be used as a handle to facilitate 2-hand operations.

b. Battery and Fuse Compartment. The battery and fuse compartment is located at the bottom of the rear panel. Both the battery and fuse are accessible by loosening the captive screw located in the center of the rear panel and sliding

the cover towards the top of the instrument.

c. General Information Labels. General information about the Danameter is printed on the labels located on the upper portion of the rear panel. These labels describe battery type, fuse type, test voltages for the battery, and general cautions.

2.6 Battery Installation. The instrument is equipped with a 9-volt, transistor radio type dry battery which will provide about 1 year of service. A mercury or alkaline 9 volt replacement battery may be used with essentially equal service life. When installing or replacing the battery, observe the following procedure (see figure 2.3).

a. Set the Danameter switch to OFF.

b. Loosen the captive screw located in the center of the back panel; swing the bail out and away from the back panel; slide the battery compartment cover up. The battery compartment cover and bail assembly can now be removed.

c. Match battery connector with mating terminals on battery and

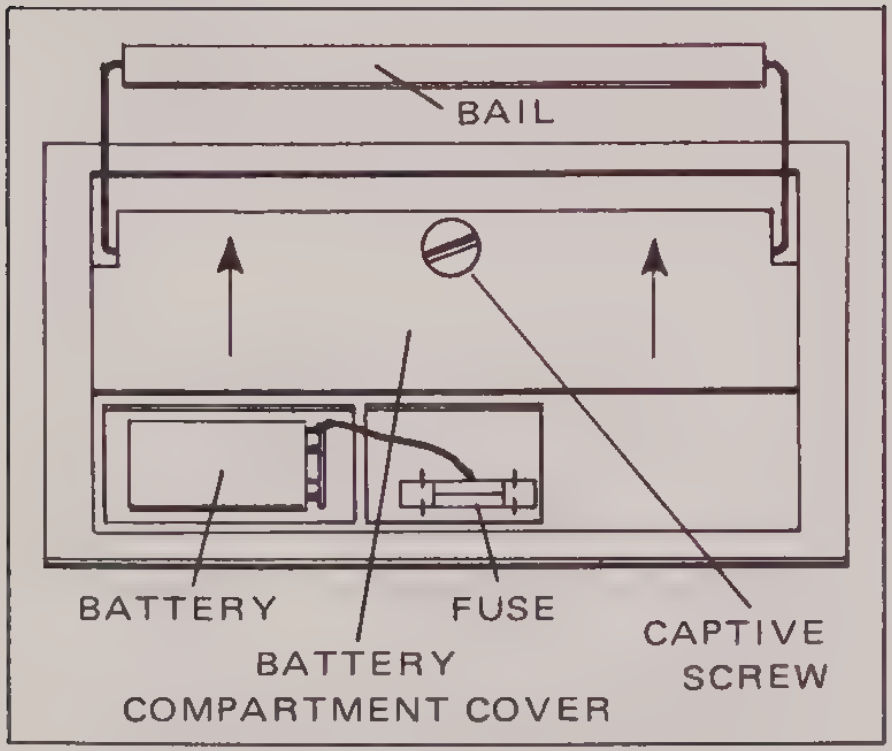


Figure 2.3 - Battery Replacement

press. If properly aligned, connector will snap on easily. If not, recheck alignment.

d. Replace battery and fuse cover; tighten captive screw.

e. Set switch to TEST; if readout is greater than 600, your Danameter is ready to use. A new battery will indicate 800-1100.

2.7 MEASUREMENTS.

WARNING

Exercise extreme caution when working near sources of high voltage. This includes any voltage measurements requiring the use of the 200V or 1000V DC or AC ranges.

2.8 General.

2.9 Standard measurement capabilities of the Danameter include DC and AC voltages, DC currents, and resistance. These standard measurements utilize the probes provided with the instrument; with the black probe occupying the – input jack and the red probe occupying the + input jack.

2.10 Overload.

2.11 Overload is a built-in capability that protects the Danameter against damage and permits probing of unfamiliar circuitry where an overload condition may be encountered. An overload condition exists whenever the input signal to the Danameter is larger than the range selected and is indicated as OL on the display. For example, with the 200 Mohms range selected and the input leads open, the display reads OL since the input signal (infinite resistance) is greater than the 200 Megohm capability of the range.

2.12 The Danameter is protected by limiting the amount of current that is permitted to flow through it. The DC and AC volt ranges and the 20 KΩ, 2 MΩ, 200 MΩ, and 20 μA ranges are protected

due to their high input impedance. The three higher DC current ranges and the 200Ω range of the ohms function are protected by a 2-1/2 amp fast-blow fuse in the Danameter that blows when an excessive current is applied.

WARNING

Do not rotate selector switch through DC current or OHMS ranges when a signal capable of producing an overload is applied to the input (e.g., 110 volts AC). Instantaneous fault currents well in excess of the fuse rating can occur resulting in severe damage to both the equipment under test and the Danameter's switches.

2.13 Procedures.

2.14 Tables 2.1 through 2.4 provide information for measuring on each function. In each case the sequence is the same:

1. Select appropriate range.
2. Connect test leads to circuit as shown.
3. Read value on display.

Table 2.1 - DC Volts

FULL SCALE INPUT	RESOLUTION	MAXIMUM INPUT:
±1.999V	1 MILLIVOLT	DC ± 1000 VOLTS
±19.99V	10 MILLIVOLT	AC 1000V PEAK (700V RMS)
±199.9V	100 MILLIVOLT	INPUT RESISTANCE:
±1000V	1 VOLT	10 MEGOHMS

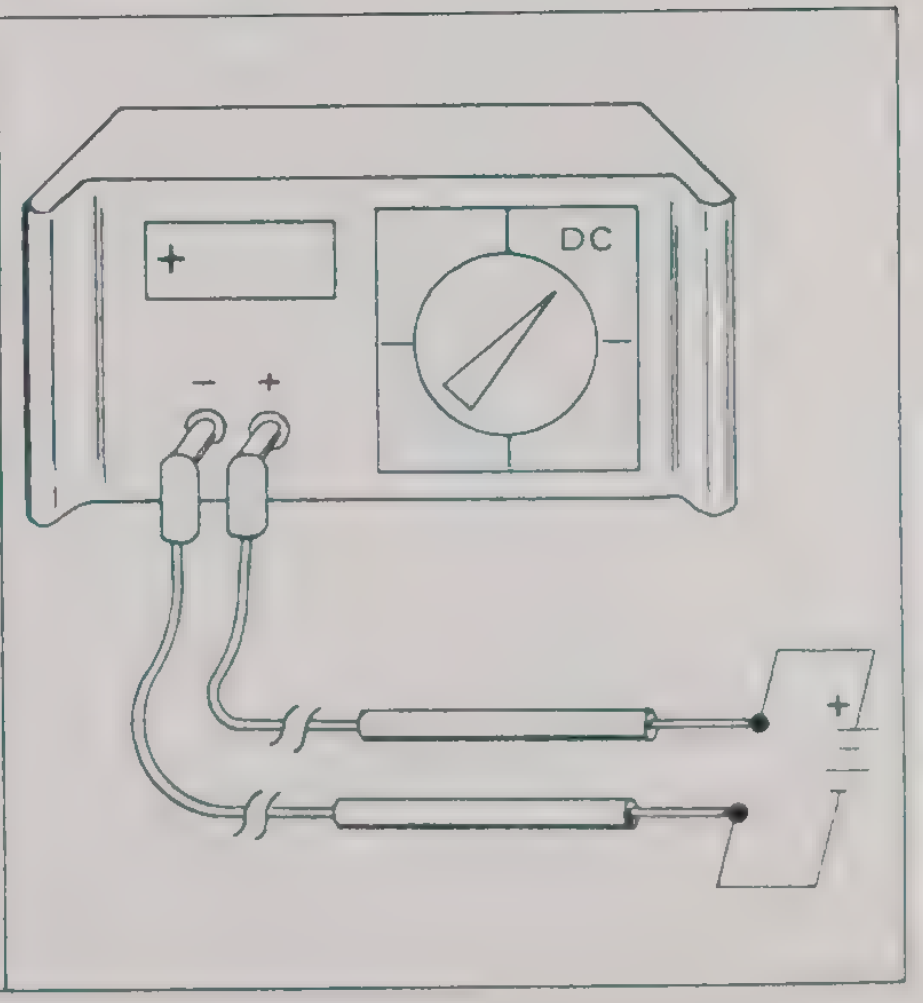
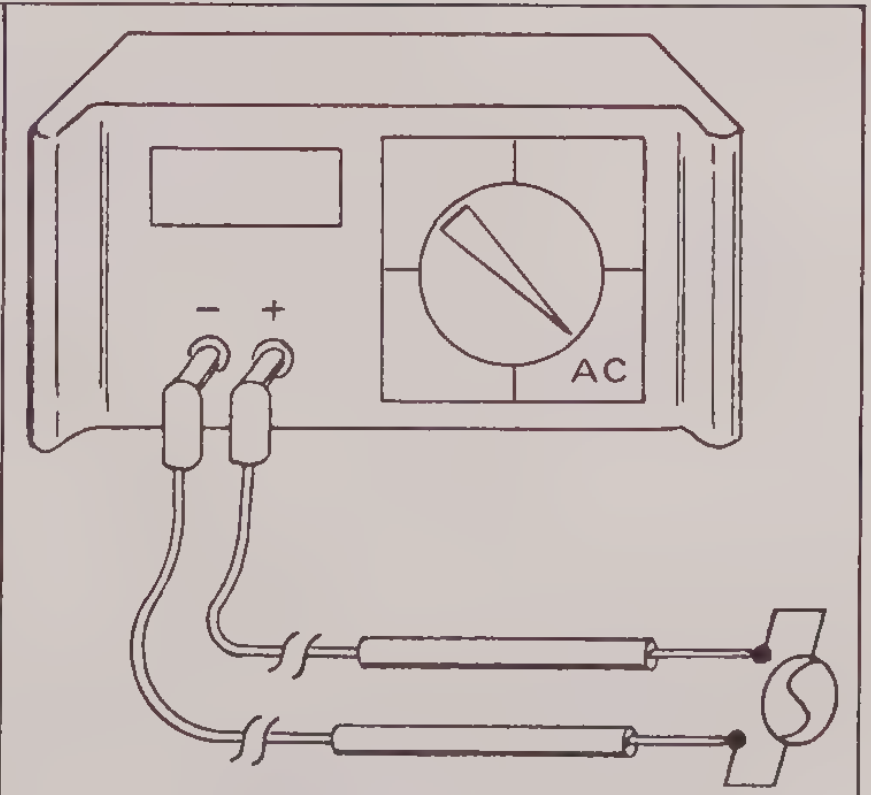


Table 2.2 - AC Volts

FULL SCALE INPUT	RESOLUTION	FREQ *	MAXIMUM INPUT:
1.999V	1 MILLIVOLT	45 Hz to 2 kHz	AC 1000V PEAK (700V RMS)
19.99V	10 MILLIVOLT	45 Hz to 5 kHz	DC ± 250 VOLTS
199.9V	100 MILLIVOLT		INPUT IMPEDANCE:
700V	1 VOLT		2 MEGOHMS



*INDICATES HIGHEST MEASURABLE FREQUENCY WITH SPECIFIED ACCURACY; MEASURES TO 10 kHz ON ALL RANGES.

Table 2.3 - DC Current

FULL SCALE INPUT	RESOLUTION	MAXIMUM INPUT:
±19.99 uA	10 nA	WITHSTANDS 250V DC OR RMS AC FOR 5 SECONDS
±1.999 mA	1 µA	FUSE PROTECTED TO: 250 VDC 250 VRMS AC
±199.9 mA	100 µA	
±1.999A	1 mA	

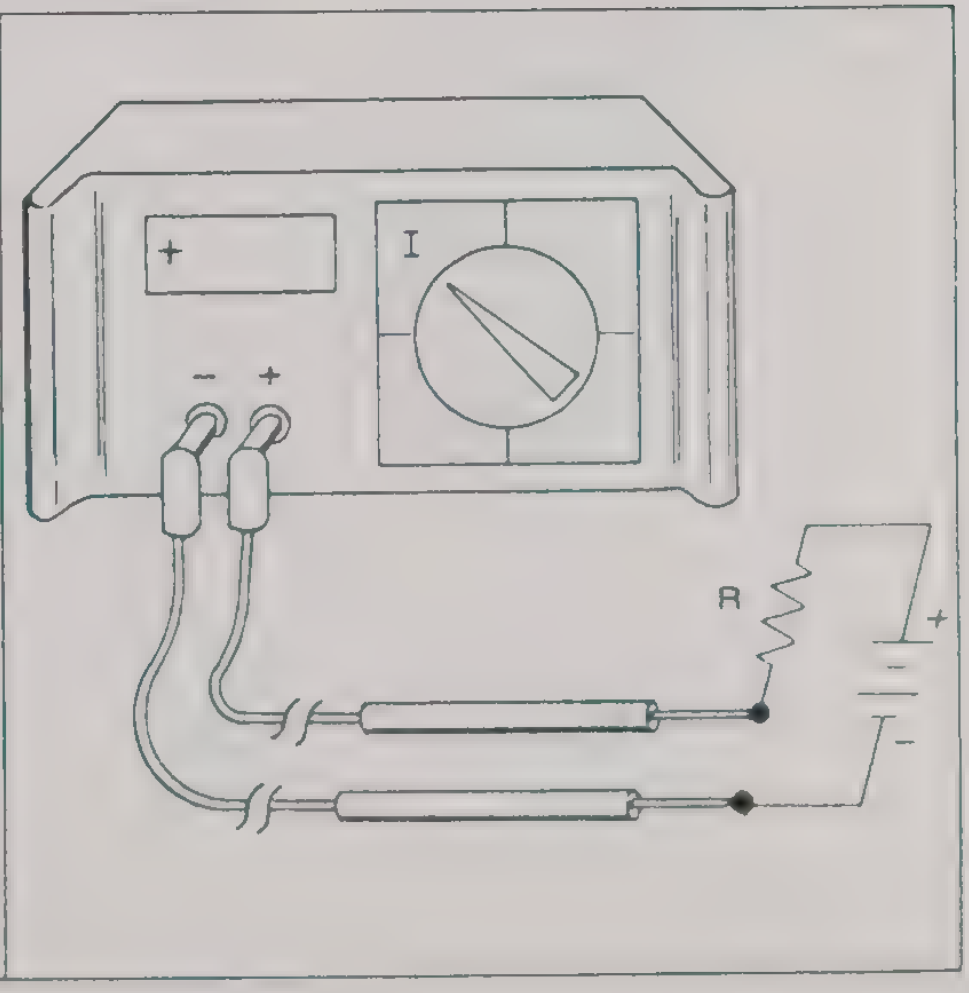
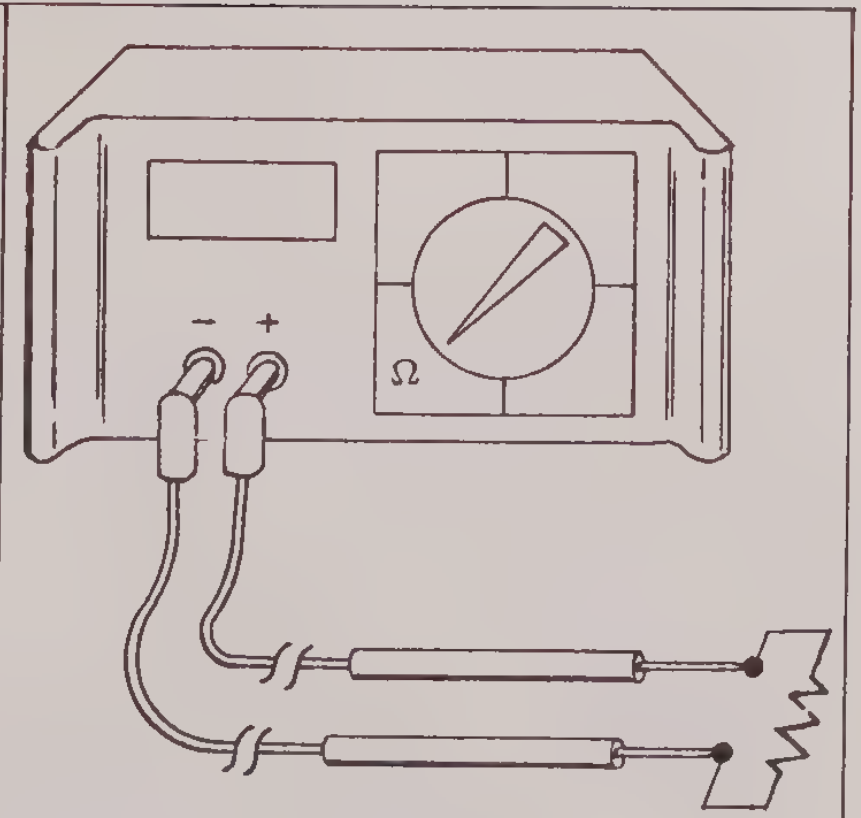


Table 2.4 - Resistance

FULL SCALE INPUT	RESOLUTION	CURRENT THROUGH UNKNOWN	MAXIMUM INPUT:
199.9Ω	100 mΩ	1 MILLIAMP	250 VDC
19.99 KΩ	10Ω	10 MICROAMPS	250 VRMS AC
1.999M	1 KΩ	1 MICROAMP	
199.9M	100 MΩ	10 NANOAMPS	



TO EXTEND BATTERY LIFE, DO NOT LEAVE DANAMETER IN RESISTANCE FUNCTION, WHEN NOT IN USE.

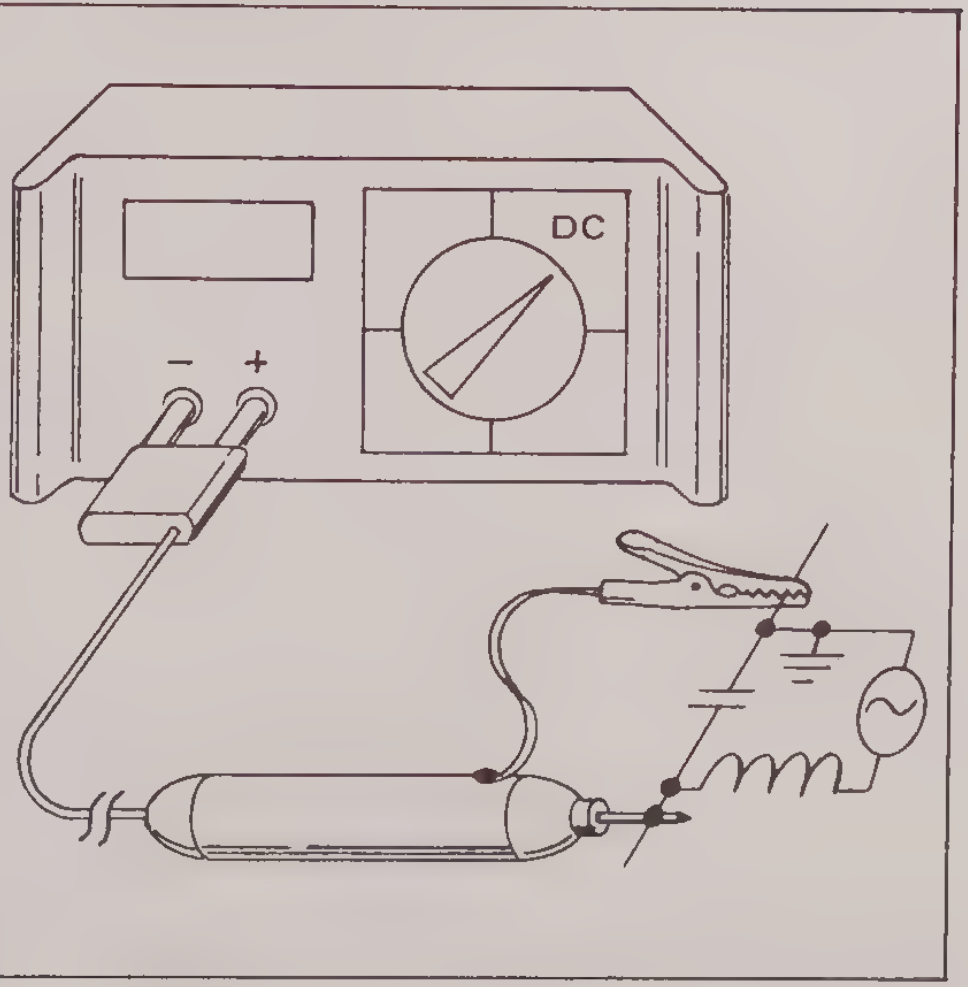
2.15 RF Probe (2040).

2.16 The RF probe accessory extends the ac measuring capability of the Danameter to 200 MHz. The AC probe replaces the standard input probes and the polarity indications on the RF probe connector should be matched with the indications on the Danameter front panel. The probe is a peak sensing, RMS calibrated device and converts the a.c. input to an equivalent d.c. level which is then measured by the d.c. function of the meter. The probe accurately measures RF voltage up to 30 volts RMS from 1 kHz to 200 MHz. The probe is clamp protected for voltages to ±250V dc or RMS ac without damage to the probe.

2.17 As shown in table 2.5, the shield clip is connected to the RF ground portion of the circuit being measured and the tip of the probe is held to the 'HOT' side of the RF circuit. The d.c. equivalent of the RF output is read on the Danameter display (the 2 VDC, 20 VDC, or 200 VDC ranges are used; 1V RMS = 1 VDC).

Table 2.5 - RF Voltage (With RF Probe Accessory)

FREQUENCY RANGE	ACCURACY
1 kHz - 10 MHz	±(1%r+0.5%F.S.) ON 20V RANGE
10 MHz - 100 MHz	±1 dB
100 MHz - 200 MHz	±3 dB
MAXIMUM READING: 30 VOLTS RMS	
INPUT IMPEDANCE: 1.6 MΩ	



2.18 High Voltage Probe (2030).

DANGER

The High Voltage Probe is used for measuring potentially lethal voltage levels. Always remove power to and discharge the source before connecting or removing the High Voltage Probe from the source.

2.19 The Danameter can be used to measure d.c. voltages to 30,000 volts with the use of the High Voltage accessory. This probe replaces the standard input leads and polarity indications on the High Voltage Probe connector must be matched with the indications on the Danameter for proper polarity indication.

2.20 As shown in table 2.6, the black lead of the High Voltage Probe is always connected to the grounded or low side of the source. The probe is a precision 1000:1 voltage divider; a maximum input of +30,000 volts is read as +30.0 volts on the 200 DCV scale. The 2V, 20V, and 200V ranges may be used; 1 KV measured equals 1V on the Danameter.

2.21 Decibels.

2.22 The gain and accuracy of electronic equipment is often expressed in dB

Table 2.6 - High Voltage (With High Voltage Accessory)

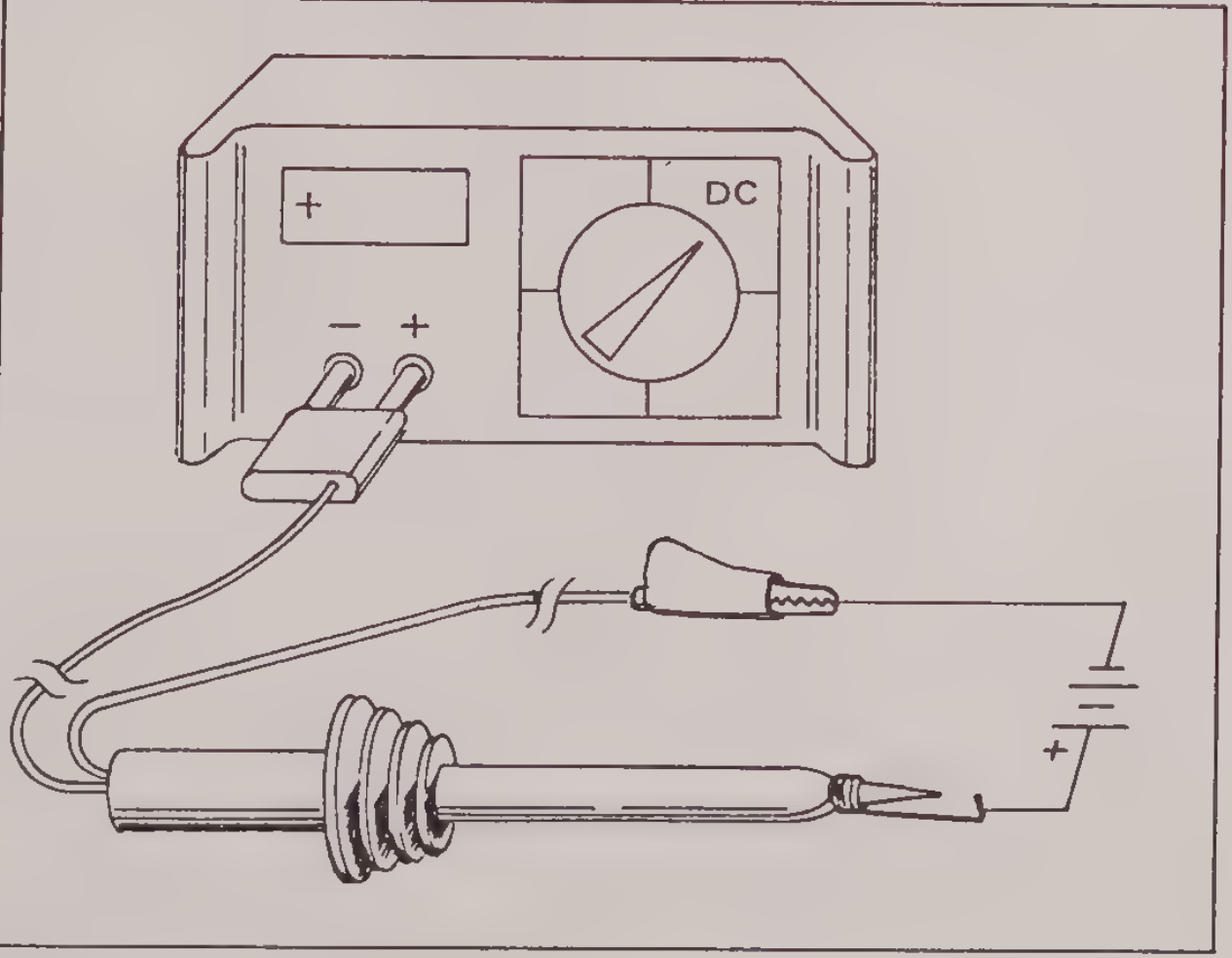
MAXIMUM INPUT:

30 KV

ACCURACY: ±5%

INPUT RESISTANCE:

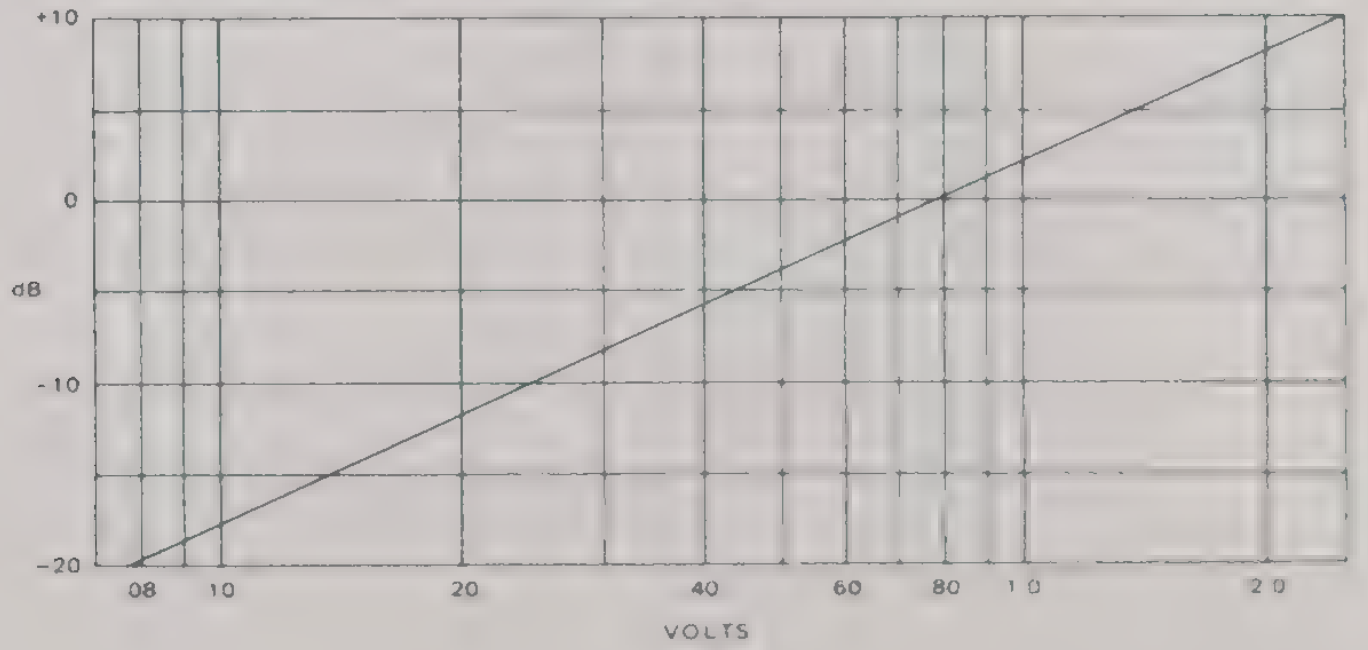
900 MΩ



or decibels. The dB is the logarithm of the ratio of two electrical signals; normally a certain amount of power across a fixed resistance is used as a reference and denoted as 0 dB. One of the most common of this standard defines 0 dB as 1 milliwatt into 600 ohms and is used for our example.

2.23 A conversion chart for converting AC voltage measurements to dB is provided in table 2.7.

Table 2.7 - Decibel Conversion Chart



20 VOLT RANGE – ADD 20 dB
200 VOLT RANGE – ADD 40 dB
1000 VOLT RANGE – ADD 60 dB

SECTION 3 THEORY OF OPERATION

3.1 GENERAL.

3.2 Mechanically, the Danameter is a completely self contained solid-state, Volt-Ohm-Milliampmeter with all active components contained in two Large Scale Integration (LSI) devices. Electrically, the Danameter converts a signal at its input jacks to a number at its display window, by a process called Dual-Slope Integration. Integration identifies the process as one in which the value of the input signal is converted to a proportional period of time; the amount of time produced is measured and displayed. Dual-slope identifies the type of integration and is so called because of the characteristic electrical output of one of the circuits used in this process.

3.3 The following discussion serves to identify and describe the major portions of the circuitry used in the instrument, shown simplified in figure 3.1.

3.4 Signal Conditioning. This circuitry modifies the input signal when required to make it compatible with the measurement circuitry. These modifications include: converting AC, resistance, and current inputs to a DC voltage level, scaling the input

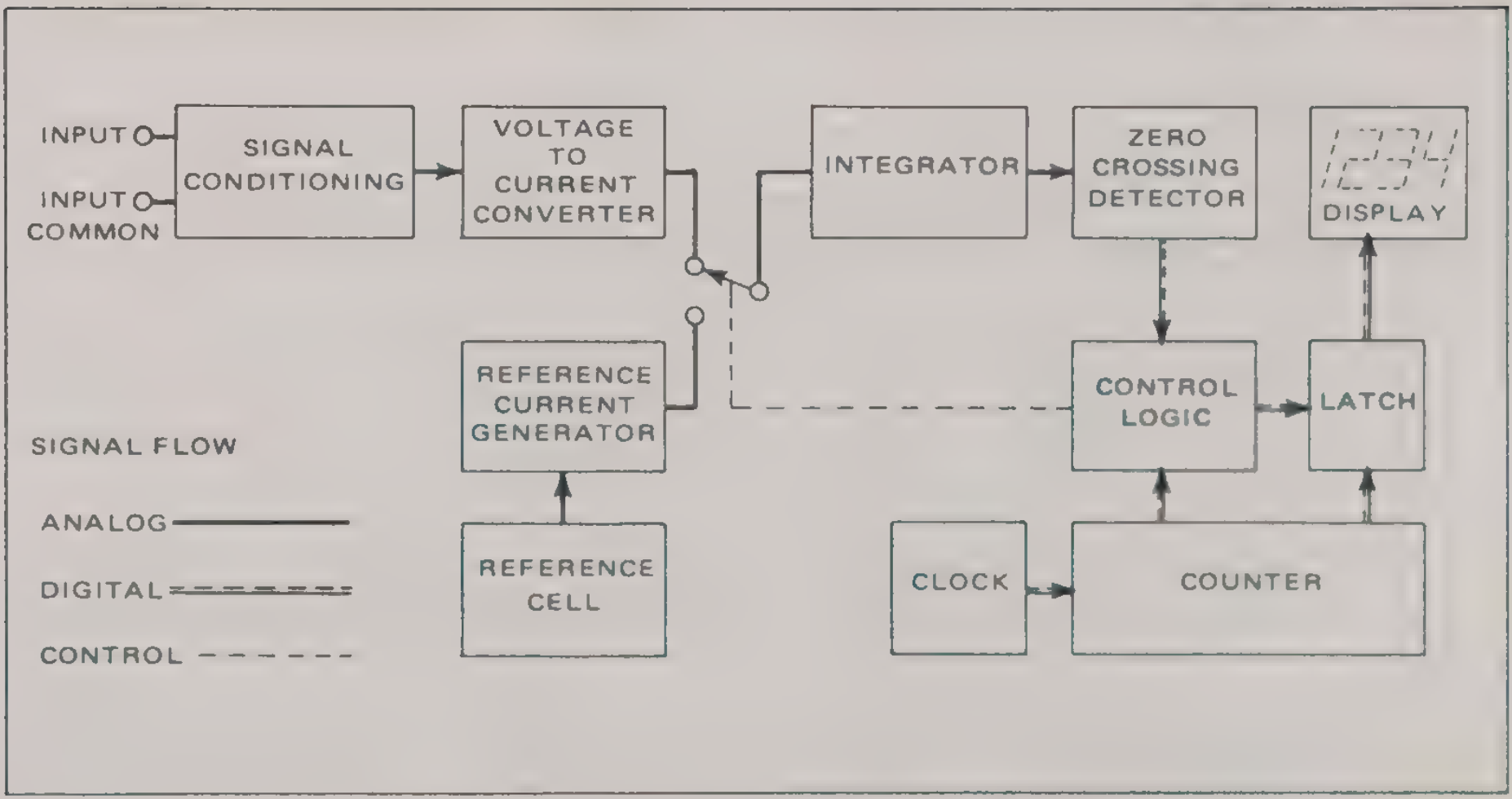


Figure 3.1 - Danameter Simplified Drawing

signal on the higher voltage ranges, and filtering the signal to attenuate any accompanying noise.

3.5 Voltage To Current Converter. This circuitry converts the conditioned input signal to a proportional amount of positive current for use during the measurement cycle.

3.6 Reference Cell. This is a 1.35 volt mercury cell used as the precise reference source for the Danameter.

3.7 Reference Current Generator. This circuit converts the reference cell voltage to a stable and accurate negative current for use during the measurement cycle.

3.8 Integrator. This circuit converts currents applied to it to a voltage ramp. The direction of the ramp is dependent on the polarity of the current; the slope of the ramp is directly proportional to the amount of current. The input of the integrator is switched to either the voltage-to-current converter or the reference current generator by the control logic. Basically, the integrator converts the input signal into a proportional time period.

3.9 Zero Crossing Detector. This circuit monitors the output of the integrator and initiates a signal when the

integrator output returns to its starting point.

3.10 Clock. The clock generates an 8 kHz square wave output used to advance the counter.

3.11 Counter. The counter is a digital circuit that is continually advanced by the clock, linearily counting from 0000 to 3999 and overflowing back to 0000. The counter measures the time period of the integrator and provides the timing required by the logic.

3.12 Control Logic. The control logic circuitry receives inputs from the counter and the zero crossing detector and from this data, controls the switching of the integrator input and the strobing of the latch.

3.13 Latch. The latch is a storage circuit for the counter. Upon command from the control logic, the latch stores the number of counts accumulated in the counter.

3.14 Display. This includes a decoder/AC driver circuit and the liquid crystal display. The decoder/driver circuitry converts the count information stored in the latch to a 7-segment code for use by the display assembly. The information stored

in the latches appears as a number in the display window.

3.15 Integration.

3.16 Integration is a two phase process and is shown graphically in figure 3.2. The first phase is called signal integration. This is a clock and counter controlled time period of 125 ms, or the time required for the counter to advance from 3000 to 0000 (1000 counts). During this period the conditioned signal from the input is converted to a proportional amount of positive current and fed to the integrator, resulting in a linearly increasing voltage potential. The rate of the increase is directly proportional to the input signal.

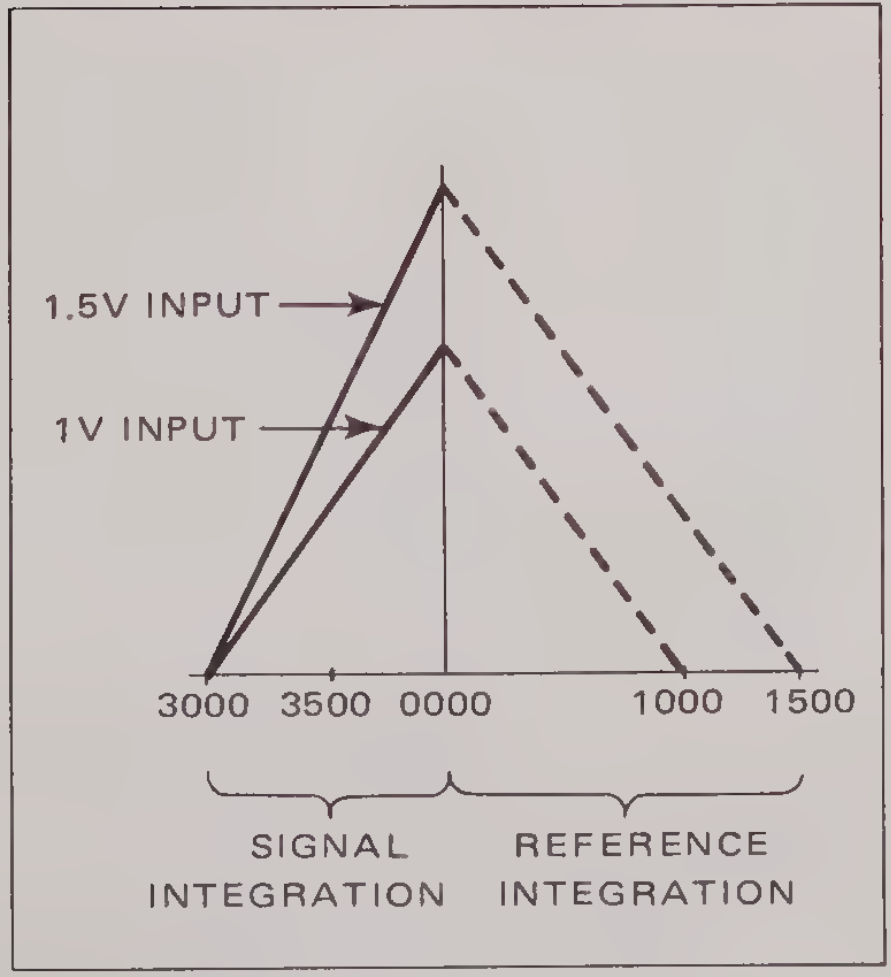


Figure 3.2 - Integrator Output

3.17 The second phase begins when the counter reaches 0000; the conditioned and converted input signal is removed from the integrator and replaced by a fixed amount of negative current. This reference current causes the output of the integrator to decrease at a fixed linear rate. When the output of the integrator returns to its original level, the zero crossing detector generates a signal that:

a. Disconnects the integrator from the reference current generator.

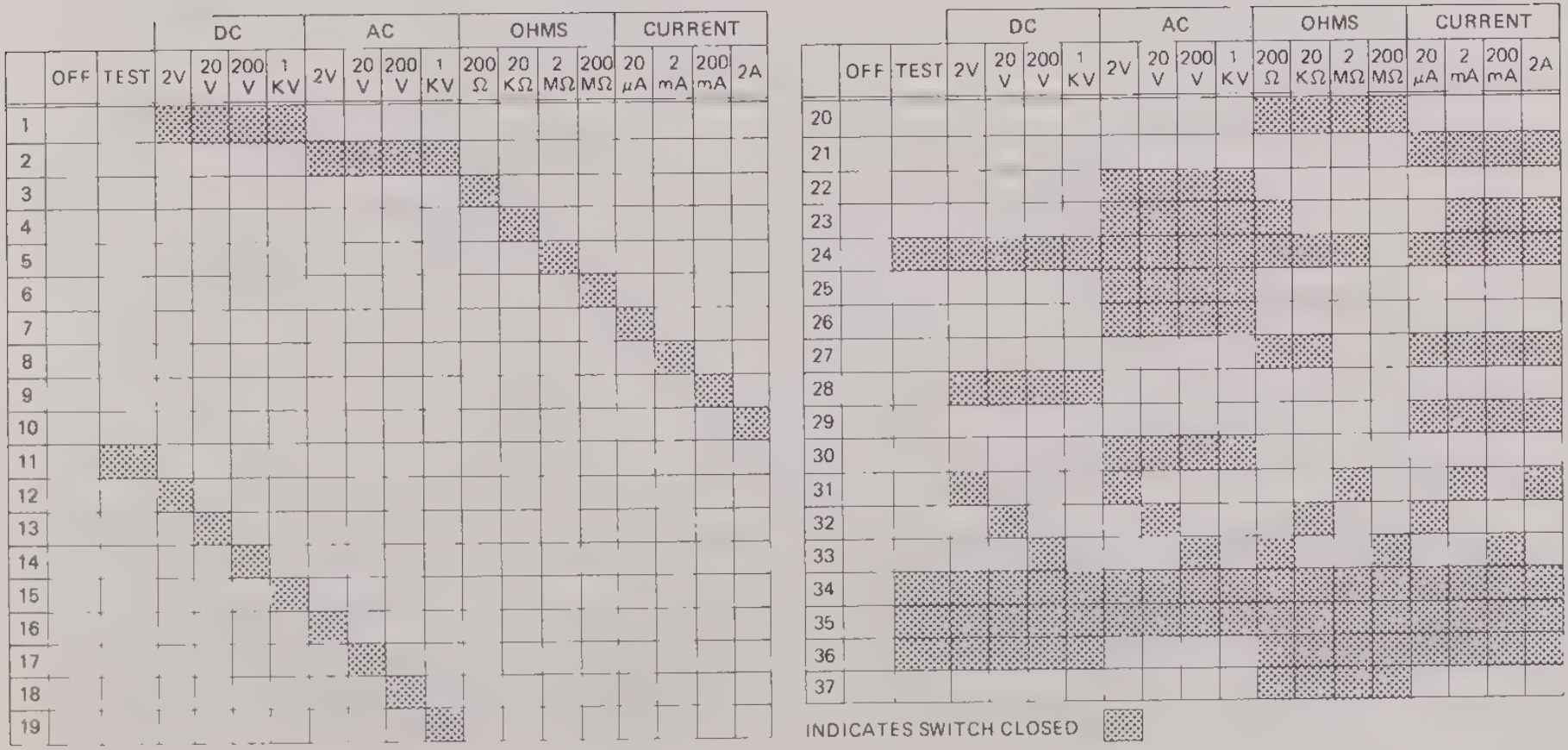
b. Commands the latches to store the setting of the counter.

The counter does not stop when the zero crossing detector signal is produced; it continues to advance until it reaches 3000 which starts a new measurement cycle. The information stored in the latches is converted to numbers on the display and is an accurate representation of the input signal.

3.18 Control Switch.

3.19 The control switch has thirty-seven normally open, single pole/single throw, cam operated switches, with 18 detented positions. The operation of the control is shown in table 3.1.

Table 3.1 - Control Switch



4.0 MAINTENANCE.

4.1 Battery Replacement.

Suitable replacement batteries are:
BURGESS 2U6 PANASONIC 006P
EVEREADY 216 RAY-O-VAC 1604
or equivalent

4.2 Battery replacement is covered in paragraph 2.6.

4.3 Fuse.

4.4 The fuse provides overload protection on some DC current and low ohms ranges and is electrically in series with the – input lead. The fuse is located next to the battery and access to the fuse is the same as described in paragraph 2.6. The fuse is a type 3AG/AGC 2.5 Amp, 250 volt.

CAUTION

Do not substitute a different value or a slo-blow type fuse in this instrument.

4.5 Reference Cell.

4.6 The reference cell provides the reference level by which all measurements are made in the Danameter for typically 3

to 5 years. The cell is replaced only if calibration is unattainable and will be installed by, or can be acquired from your dealer. The reference cell is mounted on the instruments printed circuit board as shown in figure 4.1. Access to the reference cell is the same as for calibration and is covered in paragraph 4.9.

4.7 Calibration.

4.8 Calibration returns the operation of your Danameter to its original specifications and is performed when the highest measurement accuracy is required. Calibration is available through your dealer. For those who desire to perform their own calibration and possess the necessary equipment, the following information is provided.

4.9 ACCESS TO CALIBRATION POINTS.

4.10 To calibrate the Danameter it is first necessary to remove the back cover. This is accomplished as follows.

1. Set Danameter control switch to OFF.

2. Loosen captive screw on battery cover.

3. Swing bail away from back of instrument and slide cover up.

4. Remove mounting screw at center of back.

5. Remove Battery and fuse. Lift off back and guide battery cable through hole in back cover. Reconnect Battery and fuse.

4.11 REQUIRED EQUIPMENT.

4.12 Equipment required to fully calibrate the Danameter is shown in table 4.1. The types of equipment listed is for reference only and equipment with suitable characteristics may be substituted.

Table 4.1 - Required Equipment

Name	Required Accuracy	Recommended Type
DC Standard AC Standard DC Current Standard Resistance Standard	.05%	ROTEK AC/DC Precision Calibrator Model 310
100 MΩ Standard	.1%	ESI Series SR1
Adjustment Screwdriver (Jewelers ≤ .060")		
Cliplead ≈ 6" long		

Table 4.2 - Calibration Procedure

Switch Setting	Hookup or Input	Adjust	For Readout of:
1. 200 mA	Jumper between TP1 & TP2	R29	Zero with alternate + and – sign
	Remove jumper	R20	
2. 2 VDC	DC Standard +.001 volt	R27	+.001 (+0, –1 digit)
	DC Standard +1.900 volts	R28	+1.900 (±1 digit)
3. 20 VAC	AC Standard .100V @ 400 Hz	R30	.10 (+0, –1 digit)
	AC Standard 19.00V @ 400 Hz	R12	19.00 (+2 digits)
4. 20 KΩ	Ohms Standard 19.00 KΩ	R22	19.00 (±2 digits)

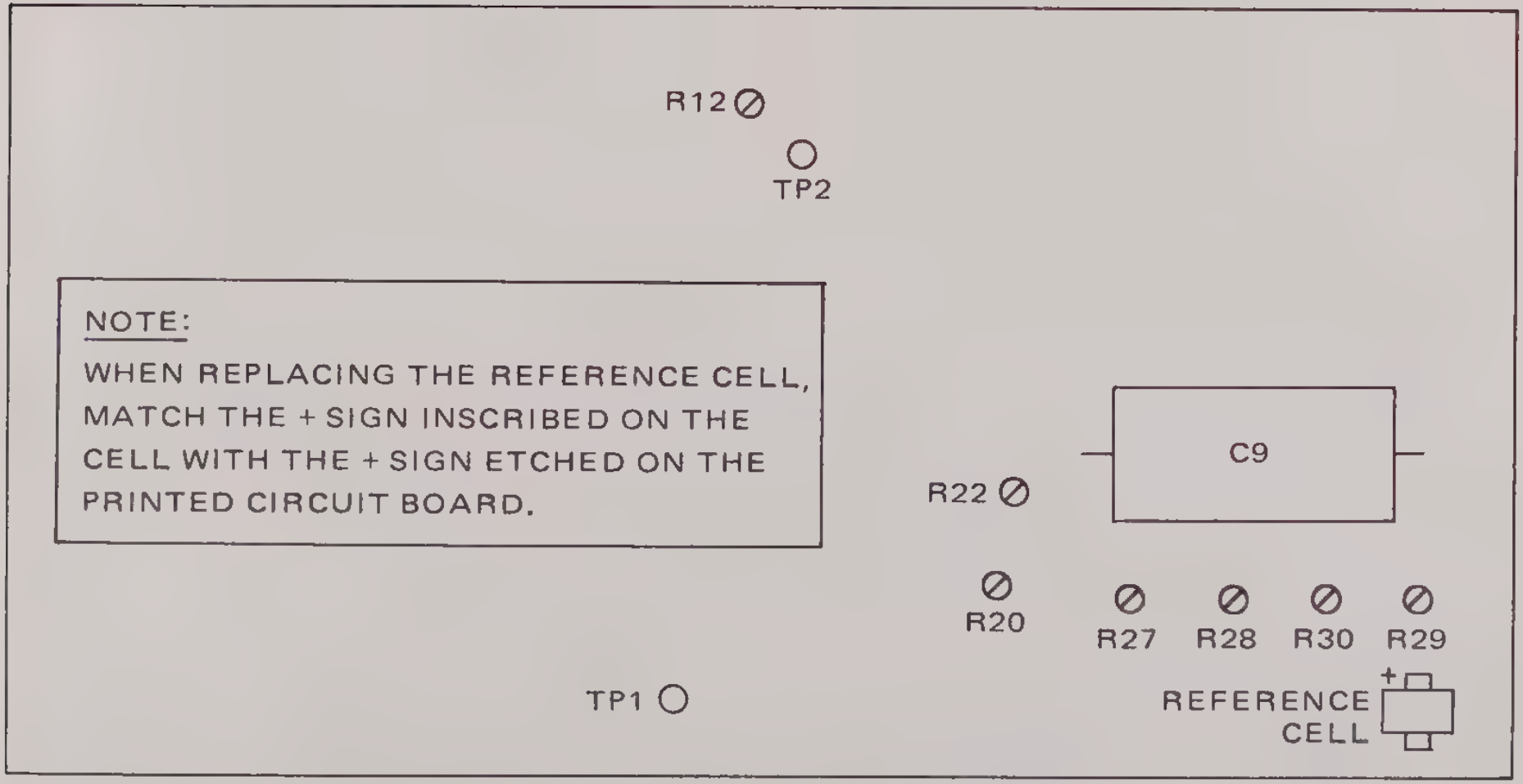


Figure 4.1 - Calibration Points

4.13 CALIBRATION PROCEDURE.

4.14 Referring to table 4.2, select the function and range on the Danameter, connect the input leads across the standard, and adjust the control for the required reading for each step. Calibration points are shown in figure 4.1 (NOTE: use a mirror placed in front of the Danameter to facilitate adjusting).

4.15 Reassemble the Danameter by reversing the procedure of paragraph 4.10. (Insure Danameter is "OFF" when installing battery.)

4.16 CALIBRATION CHECK.

4.17 This procedure is provided to verify proper accuracy on all functions and ranges following calibration. In table 4.3, select the function and range, connect the input leads to the standard, and verify the proper reading on the display for each step.

Table 4.3 - Calibration Check

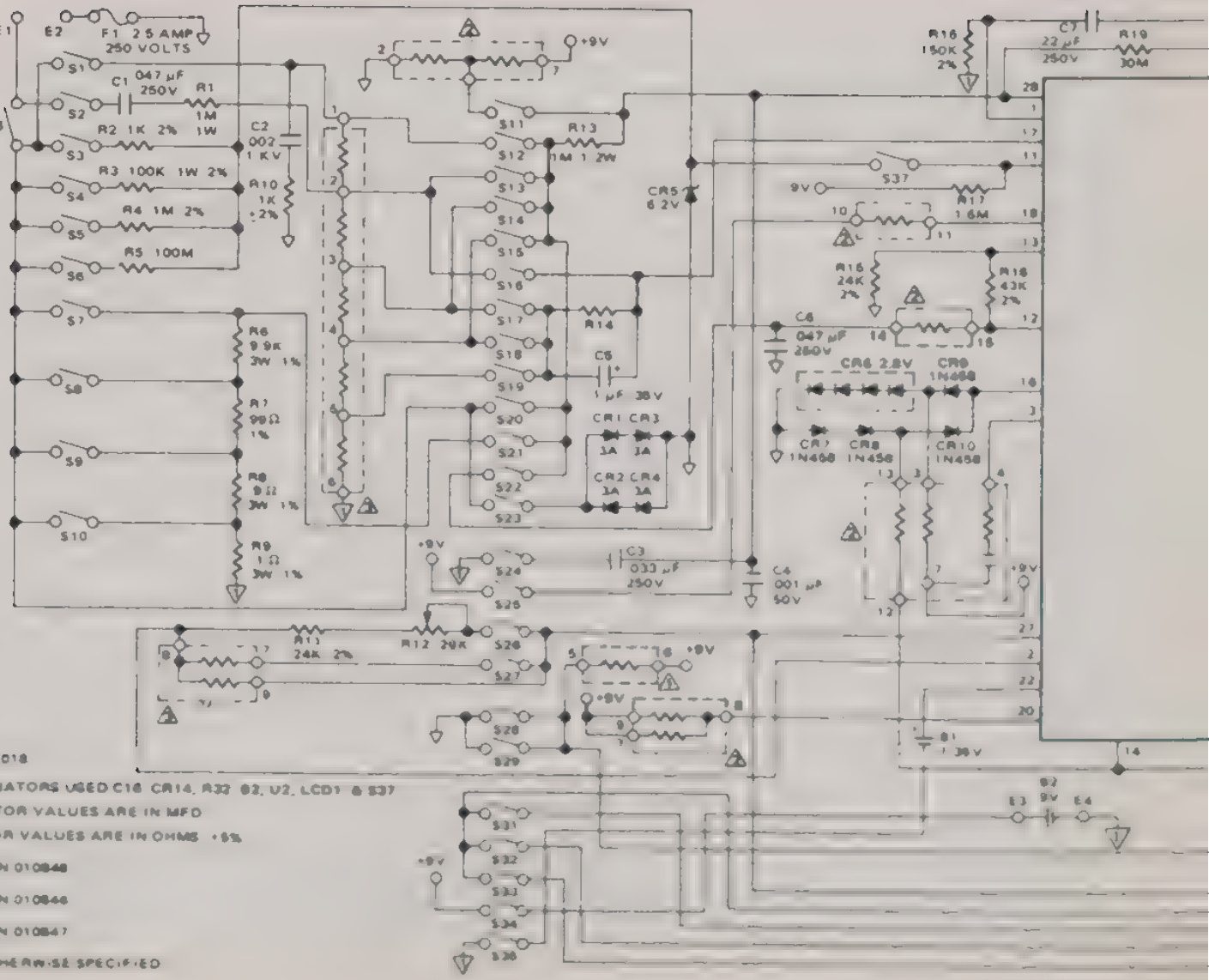
Danameter Switch	Standard		Danameter Readout	Acceptable Range
	Type	Output		
2VDC	DC	0	.000	(must read zero)
		+.1 volt	+.100	+.099 to +.101
		–.1 volt	–.100	–.099 to –.101
		+1 volt	+1.000	+.997 to +1.003
		–1 volt	–1.000	–.997 to –1.003
		+1.9 volt	+1.900	+1.895 to +1.905
		–1.9 volt	–1.900	–1.895 to –1.905
20VDC		+10 volt	+10.00	+9.95 to +10.05
200VDC		+100 volt	+100.0	+99.5 to +100.5
1KVDC		+1000 volt	+1000	+994 to +1006
Reduce standard output and remove from meter input				

Table 4.3 - Calibration Check (continued)

Danameter Switch	Standard		Danameter Readout	Acceptable Range
	Type	Output		
2VAC	AC	0	.000	.000 to .002
		.1V @ 1 kHz	.100	.095 to .105
		1V @ 1 kHz	1.000	.985 to 1.015
		1.9V @ 1 kHz	1.900	1.870 to 1.930
20VAC		19V @ 4 kHz	19.00	18.80 to 19.20
200VAC		190V @ 1 kHz	190.0	187.0 to 193.0
1KVAC		700V @ 1 kHz	700	690 to 710
Reduce standard output and remove from meter input				

Table 4.3 - Calibration Check (continued)

Danameter Switch	Standard		Danameter Readout	Acceptable Range
	Type	Output		
200Ω	Resistance	0	00.0	00.0 to 00.3
		100	100.0	97.5 to 102.5
20KΩ		10K	10.00	9.95 to 10.05
2MΩ		1M	1.000	97.5 to 1.025
200MΩ		100M	100.0	94.0 to 106.0
Remove standard from meter input				
20μA	Current	+19 μA	+19.00	+18.70 to +19.30
2mA		+1.9 mA	+1.900	+1.870 to +1.930
200mA		+190 mA	+190.0	+187.0 to +193.0
2A		+1.9A	+1.900	+1.840 to +1.960
Reduce standard output and remove from meter input				



DIODES ARE 018

LAST DESIGNATORS USED C18, CR14, R32, B2, U2, LCD1 & S37

ALL CAPACITOR VALUES ARE IN MFD

ALL RESISTOR VALUES ARE IN OHMS ±5%

SEE DANA P/N 010846

SEE DANA P/N 010846

SEE DANA P/N 010847

NOTES: UNLESS OTHERWISE SPECIFIED

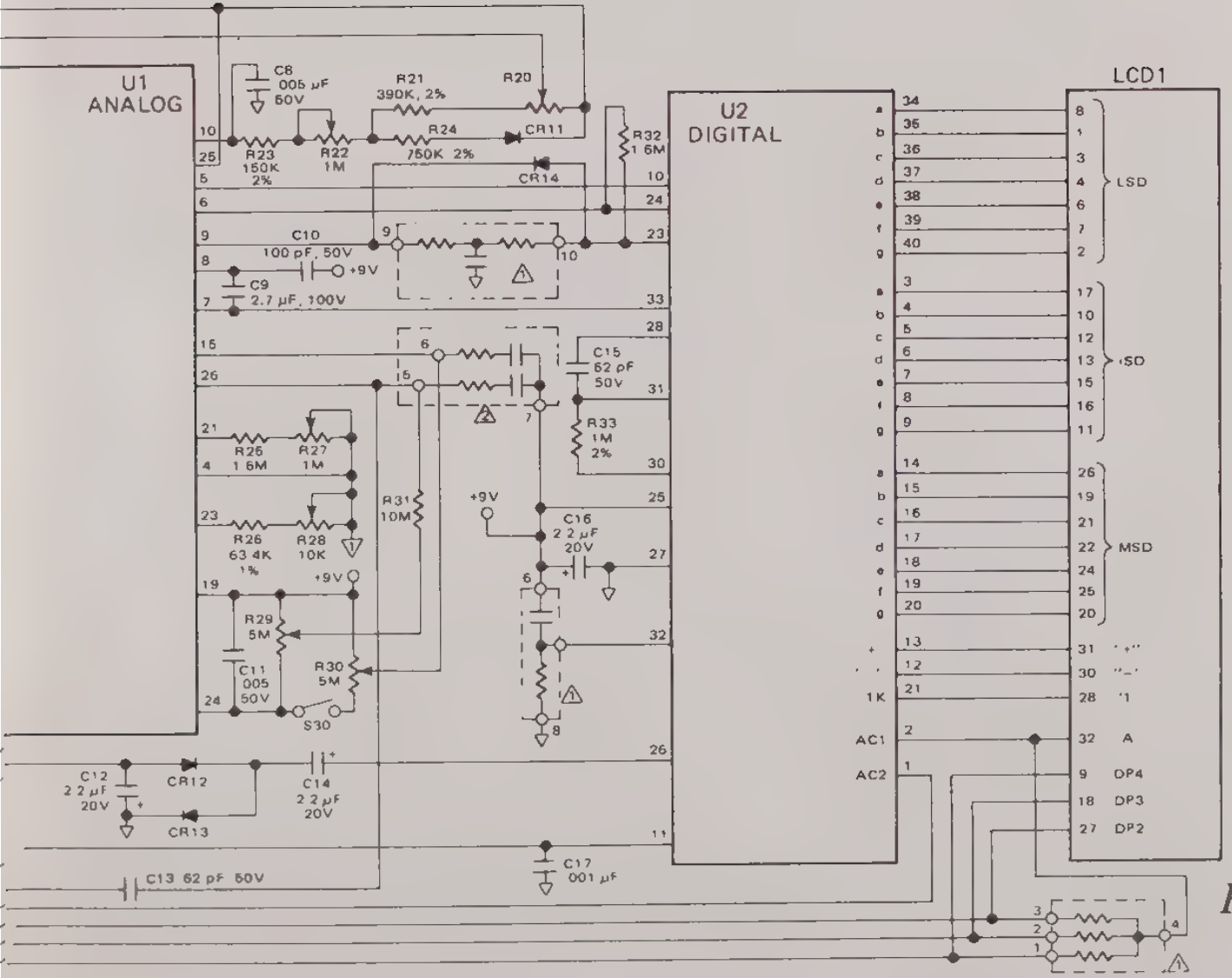
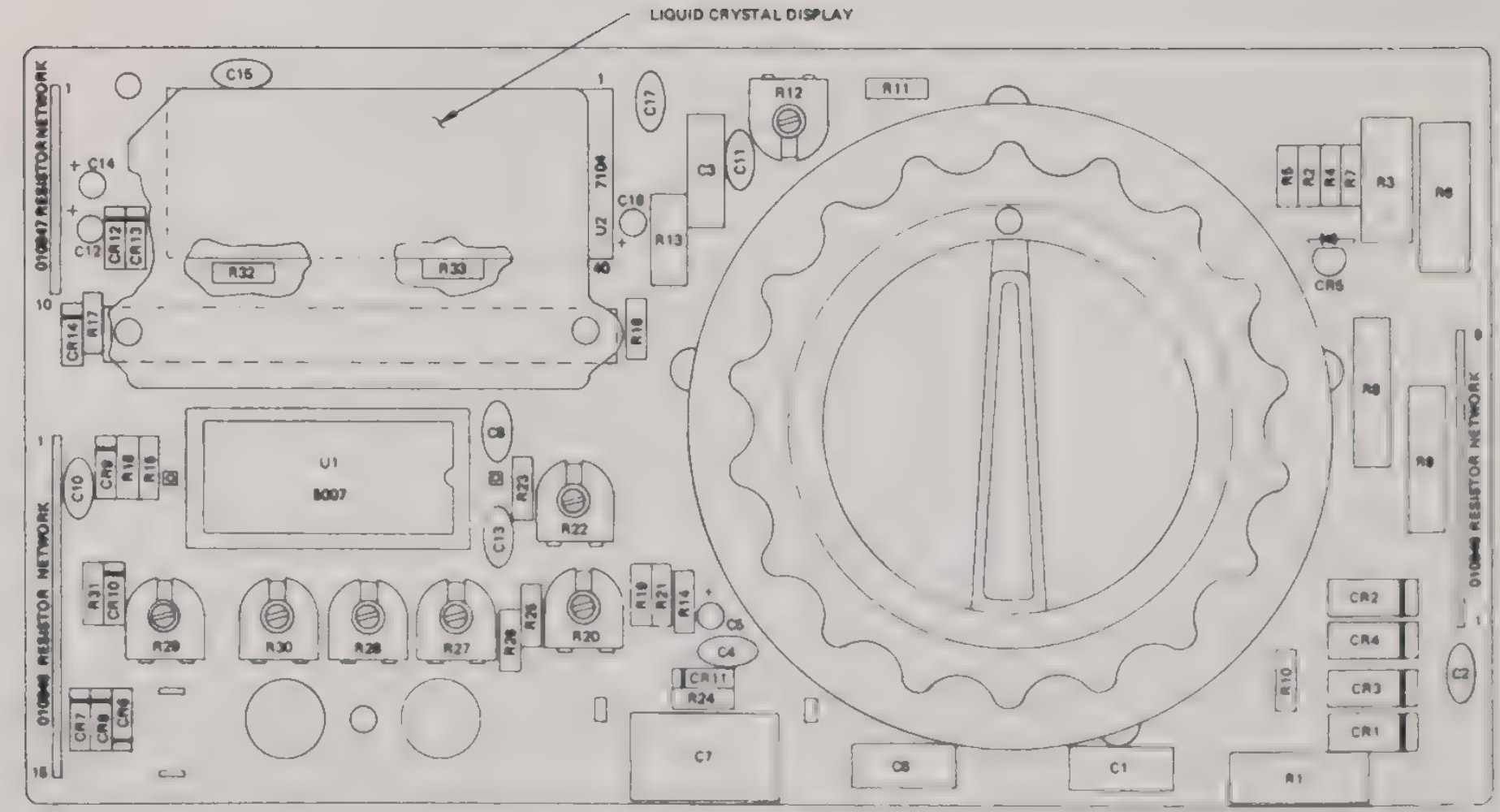


Figure 4.2 - Schematic, Danameter



4-12 Figure 4.3 - Layout, Danameter

Table 4.4 - Parts List

REF DES	DANA P/N	DESCRIPTION				
C1	120321	CAP	MYLAR	.047 µF	250V	
C2	100109	CAP	DISC	.002 µF	1000V	+50%-20%
C3	120320	CAP	MYLAR	.033 µF	250V	
C4	100108	CAP	DISC	.001 µF	500V	±10%
C5	110168	CAP	TANTA	.1 µF	35V	
C6	120321	CAP	MYLAR	.047 µF	250V	
C7	120322	CAP	MYLAR	.22 µF	250V	
C8	100110	CAP	DISC	.005 µF	500V	±30%
C9	120323	CAP	MYLAR	2.7 µF	100V	
C10	100106	CAP	DISC	100 pF	100V	±10%
C11	100110	CAP	DISC	.005 µF	500V	±30%
C12	110166	CAP	TANTA	2.2 µF	20V	±20%
C13	100105	CAP	DISC	62 pF	100V	±10%
C14	110166	CAP	TANTA	2.2 µF	20V	±20%
C15	100105	CAP	DISC	62 pF	100V	±10%
C16	110166	CAP	TANTA	2.2 µF	20V	±20%
C17	100108	CAP	DISC	.001 µF	500V	±10%

Table 4.4 - Parts List (continued)

REF DES	DANA P/N	DESCRIPTION					
CR1	210054	DIODE	RECTIFIER	3 A	50V		
CR2	210054	DIODE	RECTIFIER	3 A	50V		
CR3	210054	DIODE	RECTIFIER	3 A	50V		
CR4	210054	DIODE	RECTIFIER	3 A	50V		
CR5	220071	DIODE	ZENER		6.2V	±10%	
CR6	210059	DIODE	STABISTOR		2.8V		
CR7	210058	DIODE	1N458				
CR8	210058	DIODE	1N458				
CR9	210058	DIODE	1N458				
CR10	210058	DIODE	1N458				
CR11	210056	DIODE	MODIFIED	018			
CR12	210056	DIODE	MODIFIED	018			
CR13	210056	DIODE	MODIFIED	018			
CR14	210056	DIODE	MODIFIED	018			
R1	010855	RES	CARBON FILM	1 M		± 2%	1 W
R2	010834	RES	CARBON FILM	1 K		± 2%	1/4W
R3	010838	RES	CARBON FILM	100 K		± 2%	1 W
R4	010843	RES	CARBON FILM	1 M		± 2%	1/4W
R5	001819	RES	CARBON COMP	100 M		± 5%	1/4W
R6	020665	RES	WIREWOUND	9.9 K		± 1%	3 W

Table 4.4 - Parts List (continued)

REF DES	DANA P/N	DESCRIPTION				
R7	010832	RES	METAL FILM	99 OHM	±1.0%	
R8	020666	RES	WIREWOUND	.9 OHM	± 1%	3 W
R9	020664	RES	WIREWOUND	.1 OHM	± 1%	3 W
R10	010834	RES	CARBON FILM	1 K	± 2%	1/4W
R11	010835	RES	CARBON FILM	24 K	± 2%	1/4W
R12	040289	POT	CARBON	20 K	±20%	
R13	010844	RES	CARBON FILM	1 M	± 5%	1/2W
R14	010843	RES	CARBON FILM	1 M	± 2%	1/4W
R15	010835	RES	CARBON FILM	24 K	± 2%	1/4W
R16	010839	RES	CARBON FILM	150 K	± 2%	1/4W
R17	001871	RES	CARBON COMP	1.6 M	± 5%	1/4W
R18	010851	RES	CARBON FILM	43 K	± 2%	1/4W
R19	001820	RES	CARBON COMP	30 M	± 5%	1/4W
R20	040290	POT	CARBON	500 K	±20%	
R21	010852	RES	CARBON FILM	390 K	± 2%	1/4W
R22	040291	POT	CARBON	1 M	±20%	
R23	010839	RES	CARBON FILM	150 K	± 2%	1/4W
R24	010853	RES	CARBON FILM	750 K	± 2%	1/4W
R25	001871	RES	CARBON COMP	1.6 M	± 5%	1/4W

Table 4.4 - Parts List (continued)

REF DES	DANA P/N	DESCRIPTION				
R26	010854	RES	METAL FILM	63.4 K	± 1%	
R27	040291	POT	CARBON	1 M	±20%	
R28	040288	POT	CARBON	10 K	±20%	
R29	040292	POT	CARBON	5 M	±30%	
R30	040292	POT	CARBON	5 M	±30%	
R31	001817	RES	CARBON COMP	10 M	± 5%	1/4W
R32	001871	RES	CARBON COMP	1.6 M	± 5%	1/4W
R33	010843	RES	CARBON FILM	1 M	± 2%	1/4W
U1	230178	ANALOG	5007			
U2	230179	CMOS	DIGITAL	7104		
	600719	CONNECTOR LIQUID XTAL				
	920663	LIQUID XTAL DISPLAY				
	920699	BATTERY 9V				
	920706	TEST PROBES				
	920692	BATTERY REFERENCE CELL				

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